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WHAT MATHEMATICAL SUBJECTS SHOULD BE  
INCLUDED IN THE CURRICULUM OF THE  
SECONDARY SCHOOLS? FROM THE  
POINT OF VIEW OF THE COLLEGE.

BY ROBERT J. ALEY.

As educational thought is now adjusting itself, it seems that the time is not far distant when the secondary school curriculum will be made to meet the needs of those who are to profit by it. The college now has less influence than formerly in shaping the curriculum of the secondary school. It will have still less influence in the future unless it studies the problem from the viewpoint of present conditions and makes many needed adjustments in its requirements. I verily believe that the mathematical study which prepares best for college will prove to be of great value to the student who does not go to college.

The college needs students who know how to study. The mathematics of the secondary school, if properly taught, should develop this ability. The definiteness of its problems, and that quality in its nature which compels attention, make mathematics particularly valuable in training how to study. Secondary teachers generally should give more attention to the matter of training in methods of study. Secondary teachers of mathematics should take advantage of the nature of their subject to make this training very specific. The graduate of the secondary school who has learned how to study has a most valuable equipment. If he becomes a college freshman, he is almost certain to acquit himself creditably.

The college needs students who have courage to attack hard problems and persistency enough to make the attack successful. Testimony from many sources leads to the conclusion that the young people entering college to-day are short in this sort of courage. It is likely that this shortage is in part explained by the general movement of recent years which has tended to make school work easy and pleasant. To some extent, education has been kindergartenized. Our young people have been relieved from doing hard tasks. As a result, we find but few

college freshmen who are willing to give real effort and proper time to the hard problems that come in their work. It seems to me, then, that the college should expect the secondary school to teach and train in such a way that the type of courage needed in the doing of hard things will be developed. The mathematics of the secondary school furnishes a splendid opportunity for such training.

One of the most desirable traits that the college freshman can possess is mental alertness. The student who is awake, whose mind is receptive and who sees quickly the difficulty or explanation, is a joy to his teacher. This quality is developed only by long continued effort. The best time for its development is in the years of secondary education. It seems fair, therefore, for the college to expect the secondary school to train its students so that they may have the mental alertness needed for the best work in college. Mathematics, as well as any other subject, and better than most others, is suited to give this sort of training.

One of the hardest difficulties to overcome in the early years of college life is that of slovenly habits and lack of accuracy. The secondary school ought to develop neatness and accuracy. Mathematics, from its very nature, is well fitted to do these two things. Its results are accurate and its processes are such that neatness is necessary. If the teachers of mathematics in its earlier stages were impressed with the necessity of allowing the subject to have full power in these two particulars, the work of the college teacher would be made much easier and the possible accomplishments of the student would be much greater.

The knowledge of mathematics which the college needs and has a right to expect falls naturally into two divisions. Students who come to college ought to be familiar with the art of computing as it is illustrated in arithmetic and algebra. They ought also to understand thoroughly the scientific principles that lie back of the important truths of arithmetic, algebra and geometry. If the secondary school fails in either of these two particulars, the work in college is greatly handicapped.

I believe that the college has a right to insist that the secondary schools furnish students who know perfectly the ordinary tables of operation and who are able to carry on arithmet-

ical calculations with speed and accuracy. Much time of many freshmen is wasted in the preparation of mathematical lessons because of their inability to do ordinary arithmetical calculations with ease, precision and moderate speed.

The high school as well as the last two years of grammar school ought to give considerable training in mental calculations. Great good would result if mental arithmetic, which once played so important a part in the development of young people, were again restored to a place in the school curriculum. This subject gives power to think straight and quickly.

Both the high school and the latter years of the grammar school should give much training in short and direct methods of calculation. Nothing does more to save time and to develop mental alertness than training of this sort.

In algebra the secondary school should give a complete mastery of the fundamental operations, indices, and equations,—linear, simultaneous and quadratic. One of the important things that the secondary school often fails to do is to teach the student of algebra a proper appreciation of general quantities and type forms. If more emphasis were given to these things, the work of the freshman in college mathematics would be made much easier. College teachers generally agree that freshmen rarely understand the meaning of  $x$ ,  $n$  and  $a$  when used in general formulæ. Is it not reasonable to expect the secondary school to fix these matters in the minds of its pupils?

The training in geometry ought to result in an appreciation of the value of logical reasoning. The year and a half devoted to this subject is partially wasted if the student leaves the study without an understanding of what a proof really is. More emphasis upon reason and logic would produce not only better prepared college students, but also men better able to meet every day problems.

The work in geometry should give the student an accurate knowledge of the most fundamental geometrical facts. He ought to know intimately the properties of triangles, rectangles, parallelograms, circles and the various regular solids. This knowledge ought to be on tap in his memory, resting, however, upon a real understanding of the principles. To fix these facts in memory and make them of use, much time should be given to their application to practical problems.

The secondary schools are doing good work and are showing much interest in making their work still better. The colleges should be more sympathetic and more willing to view the problem from the secondary school standpoint. Better cooperation will result in improved products. If the secondary schools will send the colleges students who know how to work, who are open-minded and alert, who are familiar with the fundamentals of arithmetic, algebra and geometry, and who have a curiosity to know, the work in college mathematics will be greatly improved.

UNIVERSITY OF MAINE,  
ORONO, ME.